Chapter 4 – Infant and Postpartum Health

The health of an infant is dependent upon the health and well-being of the mother before, during and after delivery. According to the Life Course Model, infants who receive the healthiest start in life have the best chance for continued health and wellness into childhood, adolescence, and adulthood. This chapter focuses on those influences, highlighting the leading causes of infant morbidity and mortality.

Section 1: Maternal Postpartum Health

During the postpartum period, there are a number of factors that can influence positively or negatively the health of the mother and her newborn, including the method of delivery, the incidence of postpartum depression, and breastfeeding.

Method of Delivery

The type of delivery (e.g., vaginal or cesarean section) influences maternal and infant health. Surgical delivery, indicated for a variety of maternal or fetal conditions, is not without potential complications. Women undergoing a cesarean section are at risk for infection, hemorrhage, embolism (blood clot formation in the blood vessels or lungs), scar tissue formation, anesthesia complications, and damage to the bladder or bowel.[1] Unlike vaginal delivery in which recovery takes a few weeks, recovery from cesarean section can take twice as long (four to six weeks). For infants, passing through the birth canal during a vaginal delivery is important for optimal lung function. Because infants do not pass through the vaginal canal during a cesarean section, they can be at increased risk for lung complications. In addition, some babies may be initially lethargic due to the administration of anesthesia.[1] Therefore, the Healthy People 2010 Objective 16-9a is to reduce cesarean births among low-risk (full term, singleton, vertex presentation) women giving birth for the first time to 15 percent.

Because delivery is a major event for both mother and infant, the method of delivery has been continuously monitored since the mid -1960s. Interestingly, the proportion of live births delivered by cesarean section has fluctuated considerably in recent decades. In 1965, the proportion of cesarean sections in the United States was 4.5 percent, peaking in 1988 at 25 percent.[2] The proportion then fell to 20.7 percent in 1996, but reached 31.1 percent in 2006, the highest level ever reported in the United States.[3]

The rise in the cesarean rate is largely attributed to an increase in the primary cesarean rate,[3] defined as the proportion of live births delivered by cesarean section to mothers with no previous history of a prior cesarean section. In the United States, the primary cesarean rate for 2006 was 23.5 per 100 live births.[3]

In the late 1990s, studies demonstrated an increase in uterine rupture among women with vaginal births after a prior cesarean delivery. As a result, in 1999, the American College of Obstetricians and Gynecologists published new guidelines around vaginal delivery after

cesarean section.[4] In response to these guidelines, by 2006, 92 percent of all U.S. women with a previous cesarean section had repeat cesarean deliveries.[3] This rate far exceeds Healthy People 2010 Objective 16-9b, which is for no more than 63 percent of women to have a repeat cesarean section.

In Colorado, the proportion of vaginal deliveries, including vaginal births after cesarean sections, has been decreasing over time. In 1996, 84.9 percent of all deliveries were vaginal; however by 2008, the percentage of vaginal deliveries dropped to 74.1 percent. As seen in Figure 30, the rates for primary cesarean section, repeat cesarean section, and vaginal birth after cesarean section in Colorado have also been changing over time. In 2004, the primary cesarean section rate appears to exceed the Healthy People 2010 Objective, but the data shown include births to all mothers, not just to mothers with low-risk pregnancies (full-term, singleton, and vertex presentation). The proportion of live births by repeat cesarean section has also been increasing with a slight dip observed in 2007 and 2008. The rate of vaginal birth after cesarean has been decreasing from a high of 2.9 percent in 1996 to the current rate of 1.7 percent in 2008.[5]

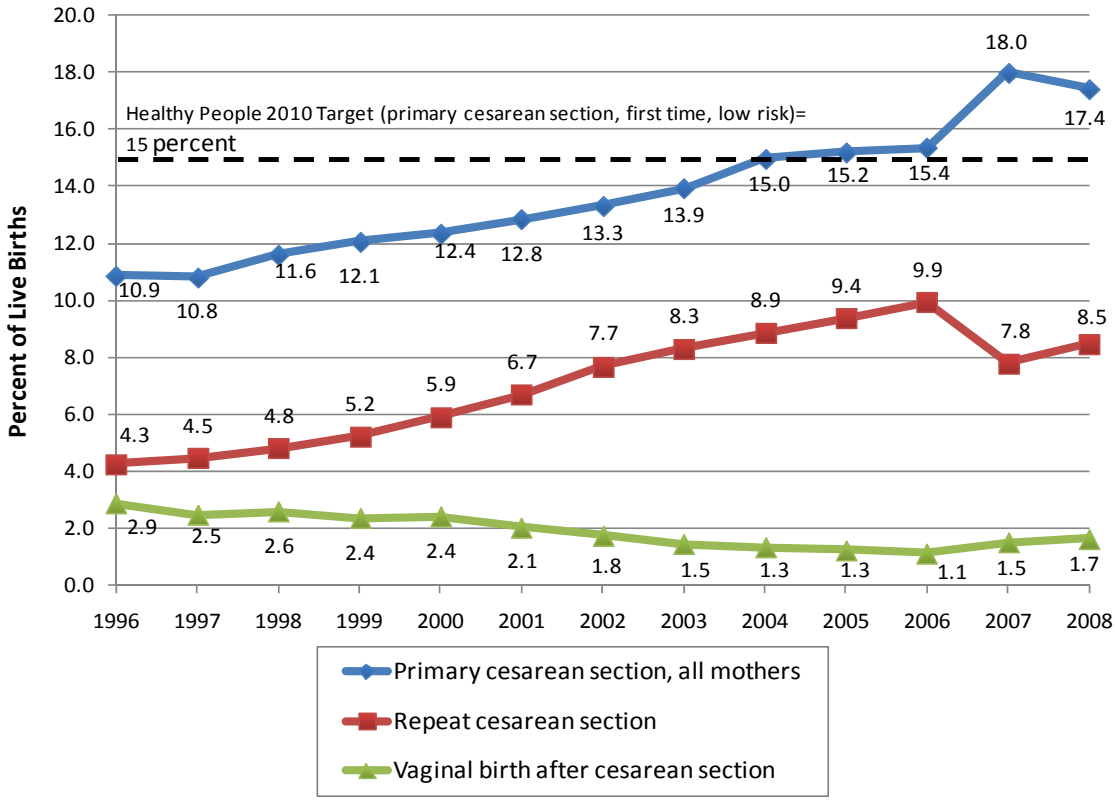

Figure 30. Percent of Live Births by Method of Delivery (Primary Cesarean Section, Repeat Cesarean Section, and Vaginal Birth after Cesarean Section), Colorado, 1996-2008

Source: Colorado Department of Public Health and Environment, Colorado Birth Certificate Data

It is assumed that the proportion of primary cesarean sections has been on the rise in recent years, at least in part, because of concerns over malpractice litigation.[6] The escalating number

of multiple births may also play a role in that surgical delivery is associated with multiple gestation.[7-8] In addition, there is a concern that "consumer demand" may also be driving the rate, as some women are electing a cesarean delivery. Finally, the induction of labor leads to higher cesarean section rates, particularly when the cervix is unprepared.[9]

Although the notion of consumer demand/doctor preference cannot be validated with any population-based surveillance data, increasing trends in late preterm cesarean section delivery (35 to 36 weeks) suggest that some of these result from elective cesarean sections that are not medically indicated. As seen in Figure 31, among Colorado women, the two-year average of cesarean section delivery for 2007–2008 was 25.9 percent of all live births, ten percentage points higher than the two-year average for the ten years prior (1997–1998). Interestingly, the greatest difference between the two time periods is observed among infants with gestational ages at 35 and at 36 weeks (where for both groups of infants the difference between the proportions of infants who were delivered by cesarean section in each time period was approximately 13 percentage points).

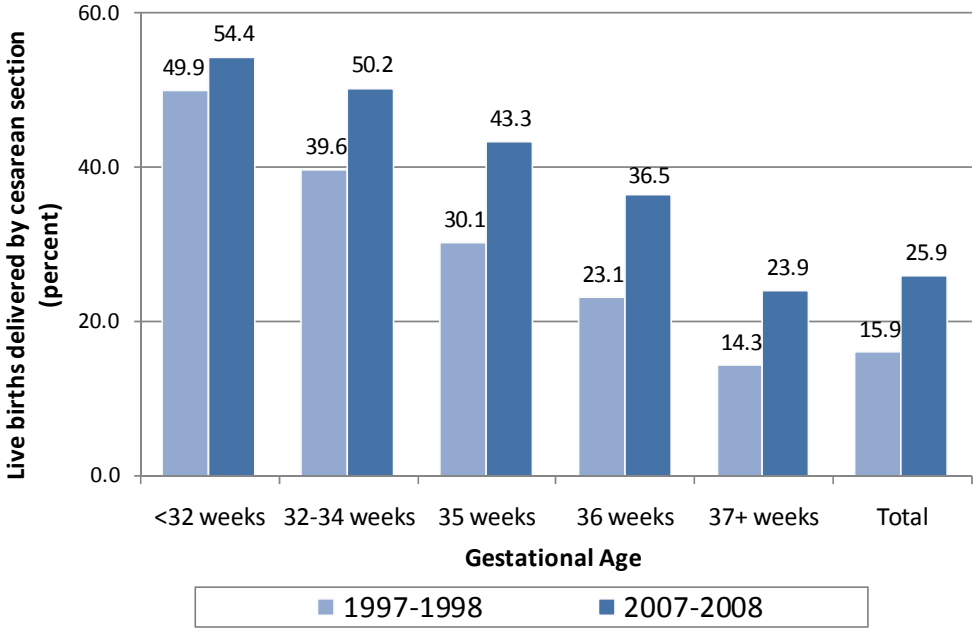

Figure 31. Percent of Live Births Delivered by Cesarean Section by Gestational Age, A Comparison of Two Time Periods, Colorado, 1997-1998 and 2007-2008
Source: Colorado Department of Public Health and Environment, Birth Certificate Data

Postpartum Depression

Postpartum depression is one of the most common complications of childbirth.[10-11] Signs and symptoms of depression include depressed mood, guilt, anxiety, irritability, insomnia, loss of interest and pleasure, tearfulness, sadness, anger, and in some cases thoughts of harming oneself or the infant.[12] Although as many as 50 to 80 percent of mothers experience the baby blues, a period of mild depression that lasts no longer than two weeks following delivery, a small proportion of new mothers experience postpartum depression that can last up to one year after delivery. Recent studies of postpartum depression have demonstrated that the

condition can negatively impact the infant, with effects persisting into childhood.[13] Identifying postpartum depression is important for reducing adverse outcomes for both the mother and infant. Although postpartum depression was included as a developmental objective as part of Healthy People 2010, a proposed objective in Healthy People 2020 (MICH HP2020-24) has been developed to assess the percentage of women attending a postpartum care visit with a health worker.

According to 2008 Colorado Pregnancy Risk Assessment Monitoring System (PRAMS) data, 84 percent of all Colorado pregnant women reported that a health care worker talked with them about postpartum depression. Among women receiving prenatal care paid for by Medicaid, 90 percent reported they received information on postpartum depression from a health care worker, a significant difference ($p < 0.05$) from women not receiving Medicaid.[14] A recent analysis of PRAMS data (2005–2007) indicated that 20 percent of women on Medicaid reported postpartum symptoms following delivery, which is double the proportion reported by women not receiving Medicaid.[12] Among Hispanic women (all races) receiving prenatal care paid for by Medicaid, 18 percent reported postpartum depression symptoms following delivery; this is almost two times as high when compared to Hispanic women (all races) not receiving Medicaid (10 percent). Similarly, among non-Hispanic women (all races) receiving prenatal care paid for by Medicaid, 21 percent reported postpartum depression symptoms after delivery, a twofold increase compared to non-Hispanic women (all races) not on Medicaid (10 percent). Postpartum depression symptoms are more likely to occur among women whose prenatal care was paid for by Medicaid, regardless of Hispanic ethnicity.[14]

Breastfeeding

Both mothers and infants benefit from breastfeeding. Women who breastfeed have lower rates of type 2 diabetes, and breast and ovarian cancers compared to women who do not breastfeed.[15] For infants, breastfeeding reduces morbidity and mortality from conditions such as otitis media, respiratory tract infections, and gastroenteritis. Further, breastfeeding reduces the risk of infant death from sudden infant death syndrome.[16] Breastfeeding is also associated with a reduction in the development of conditions later in life such as type 2 diabetes and obesity.

<u>Initiating and Sustaining Breastfeeding</u>

In Colorado, almost all infants are born in either a hospital or a birthing center. Although time spent in these facilities after delivery is limited, the early postpartum period is considered critical to support breastfeeding success among new mothers.[17] According to the National Immunization Survey, the prevalence of children ever breastfed in the United States rose from 68 percent in 1999 to 74 percent in 2006, and has almost met Healthy People 2010 Objective 16-19, for 75 percent of mothers to initiate breastfeeding.[18] In Colorado, the 2006 prevalence of children ever breastfed is 83 percent, exceeding the Healthy People 2010 target.[18]

Progress has also been made in terms of the duration of breastfeeding. In the United States, the prevalence of women breastfeeding until six months postpartum has increased from 33 percent in 1999 to 43 percent in 2006.[18] In Colorado, the 2006 prevalence of breastfeeding at six

months is 60 percent, higher than the national percentage and exceeding the Healthy People 2010 target (Objective 16-19) of 50 percent.[18] Similar results are observed at one year. The 2006 prevalence of breastfeeding at 12 months in the United States was 23 percent and the Colorado prevalence was 31 percent, which exceeds the national prevalence and Healthy People 2010 Objective 16-1 of 25 percent.[18]

In order to help mothers prepare for breastfeeding, it is recommended that healthcare providers discuss breastfeeding with pregnant women prior to delivery. In 2008, the prevalence of Colorado women who discussed breastfeeding during prenatal care visits was 84 percent, and the prevalence of women reporting breastfeeding for nine or more weeks after delivery was 70 percent.[14] The top reasons that Colorado women reportedly stopped breastfeeding were: 1) not producing enough milk (perceived or actual) (44 percent); 2) did not satisfy baby (41 percent); 3) baby had difficulty nursing (27 percent); and, 4) mother went back to school/work (21 percent).[14]

Successful Practices to Promote Breastfeeding in a Hospital Setting

In Colorado, analysis of data for 2002–2003 demonstrated that significant improvements in breastfeeding duration resulted when mothers participated in five specific activities while still in the hospital. These include five of the ten World Health Organization recommended steps to successful breastfeeding practice, specifically 1) breastfeeding initiation within the first hour of delivery; 2) infant fed only breast milk in the hospital; 3) infant stays in the same room as the mother in the hospital; 4) infant does not use a pacifier; and, 5) mothers are given a telephone number to call for help with breastfeeding prior to discharge.[19]

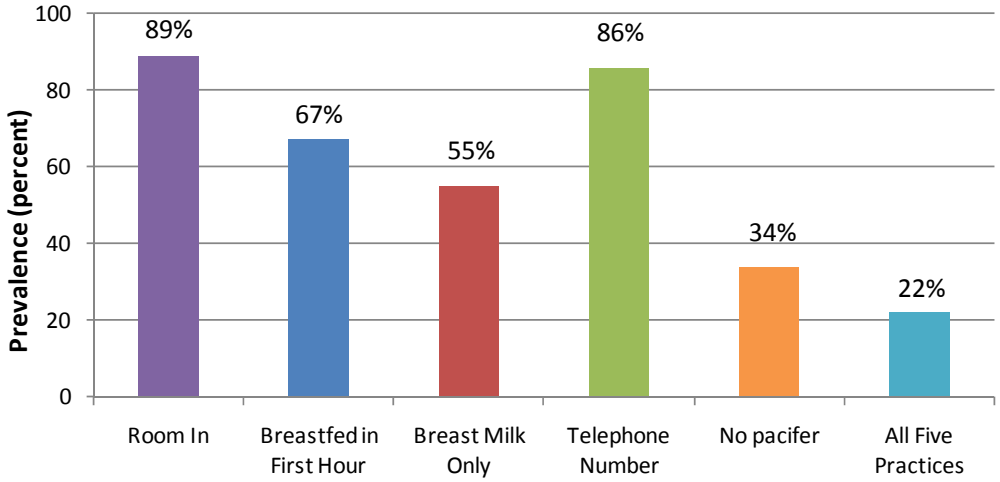

Figure 32. Percent of Mothers Reporting Five Successful Hospital Breastfeeding Practices, Colorado Residents, 2008

Source: Colorado Department of Public Health and Environment, Pregnancy Risk Assessment and Monitoring System

As seen in Figure 32, the 2008 prevalence of Colorado women rooming with the baby at the hospital was 89 percent; the prevalence of women breastfeeding within the first hour of delivery was 67 percent; and the prevalence of women receiving a telephone number for breastfeeding support was 86 percent. In addition, the prevalence of infants receiving only

breast milk was 55 percent, and the prevalence of infants not using a pacifier at the hospital was 34 percent. In 2008, the prevalence of Colorado women experiencing all five best practices was 22 percent. Among the recommended best practices, the lowest percentage related to prohibiting pacifier use (34 percent). Recommendations from the American Association of Pediatrics may be influencing this percentage, as pacifier use after one month of age has been recommended for preventing sudden infant death syndrome.[20]

Together, all five practices influence the duration of breastfeeding. In a recent analysis of breastfeeding practices (2005–2006), a greater proportion of women with healthy infants who experienced all five hospital best practices breastfed babies through 20 weeks, as compared to mothers with healthy infants who did not receive all five. This finding is observed in Figure 33; the shaded region signifies a statistically significant difference (for weeks two through 19).

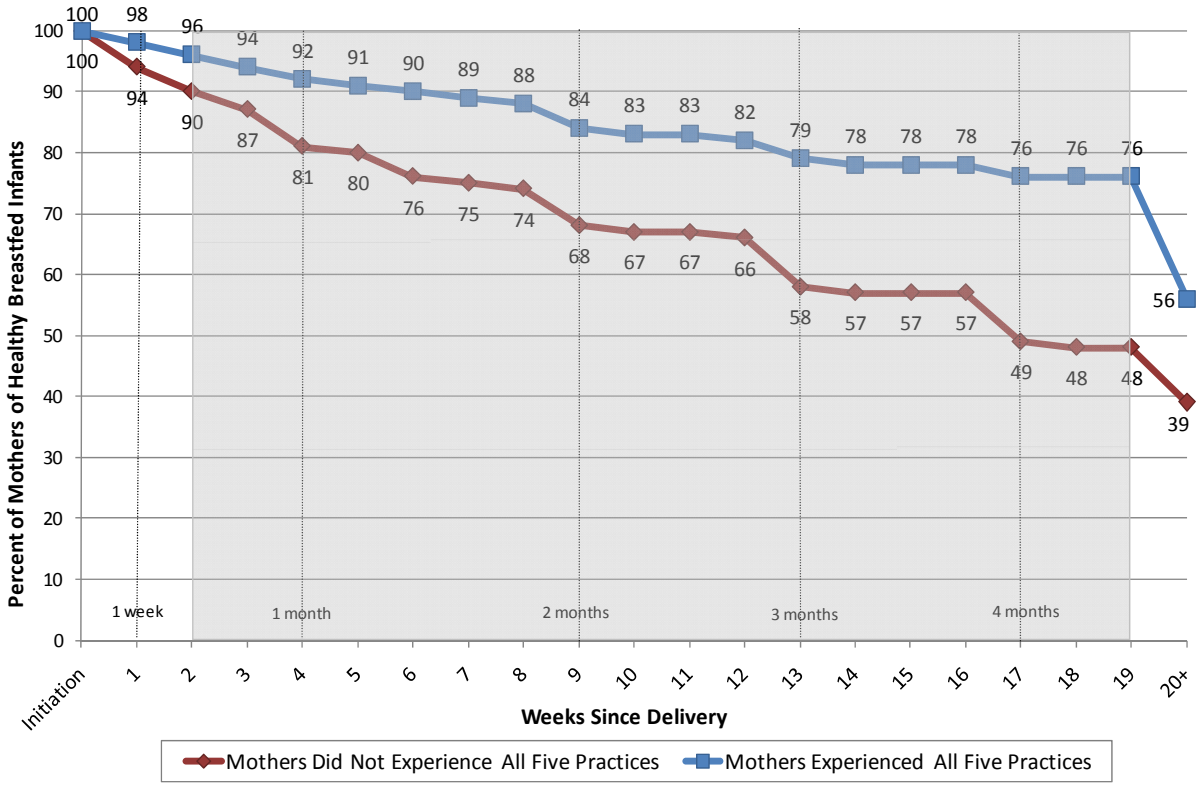

Figure 33. Colorado Breastfeeding Duration Rates among Mothers of Healthy Breastfed Infants, by Five Successful Hospital Breastfeeding Practices, Colorado Residents, 2005-2006

Source: Colorado Department of Public Health and Environment, Pregnancy Risk Assessment and Monitoring System

Nationally, three new Healthy People 2020 objectives have been proposed to improve breastfeeding. Two of the three are specific to improving hospital breastfeeding practices: 1) decrease the prevalence of breast-fed newborns who receive formula supplementation within the first two days of life (MICH HP2020-27); and, 2) increase the percentage of live births that occur in facilities providing recommended care for lactating mothers and their babies (MICH HP 2020-28). The other objective is specific to increasing the percentage of employers who have worksite lactation programs (MICH HP2020-26).

Section 2: Infant Mortality

At the turn of the 20th century, 100 infants per 1,000 live births died before the age of one.[21] Since then, the U.S. infant mortality rate has decreased dramatically to 6.7 deaths per 1,000 live births (2006).[22] The decrease is attributed to a number of factors including access to health care and availability of hospitals and maternity wards, increased awareness of nutrition, improved medical imaging and technology, and the rise in the standard of living and educational levels of women.[21]

Still, the United States has a comparatively high infant mortality rate, ranking 30th in the world during 2005, despite having the highest gross domestic product (a measure of economic output). The U.S. infant mortality rate is higher than many countries with high-income economies such as Sweden, Hong Kong, Japan, Finland, and Norway,[23] plus some countries with second tier economies like Poland and Cuba.[24]

In a 2004 study of infant mortality that compared the United States and Europe, the National Center for Health Statistics identified a lower infant mortality rate for preterm (< 37 weeks of gestation) infants born in the United States; however, the U. S. has a disproportionately higher number of preterm (< 37 weeks) births compared to Europe.[23] The study noted that much of the high infant mortality rate in the United States was due to the high percentage of preterm births. For example, if the United States had the same distribution of births by gestational age as observed in Sweden, the U.S. infant mortality rate would be reduced by one-third. In the United States, most premature and fragile infants are likely to be born to low-income and minority women lacking health care and social support.[23]

In 2008, the infant mortality rate in Colorado was 6.2 deaths per 1,000 live births. During that year, Colorado had 434 infant deaths out of 70,028 live births. The infant mortality rate has been decreasing for over 10 years. Since 1998, the number of Colorado births has increased by 18 percent, while the number of infant deaths has remained constant (on average approximately 415 infant deaths per year). Healthy People 2010 Objective 16-1 proposes to reduce the rate of infant deaths to no more than 4.5 per 1,000 live births (Figure 34).[25] As of 2007, no state in the nation had met the Healthy People 2010 target.

The infant mortality rate varies by race and ethnicity, with wide disparities for Black/African American infants. In 2006-2008, the infant mortality rate for Black/African American (non-Hispanic) was 13 deaths per 1,000 live births, a decrease from 17 deaths per 1,000 live births during the previous 18 years. There may also be a disparity for Hispanic infants (all races) whose death rates have varied from nearly 10.0 deaths per 1,000 live births during 1991-1993 to 7.4 deaths during 2006-2008. Asian American/Pacific Islander infants had the lowest infant mortality rate at 4.6 per 1,000 during 2006-2008. This is the only population to have met the Healthy People 2010 objective during the last decade (Figure 34).

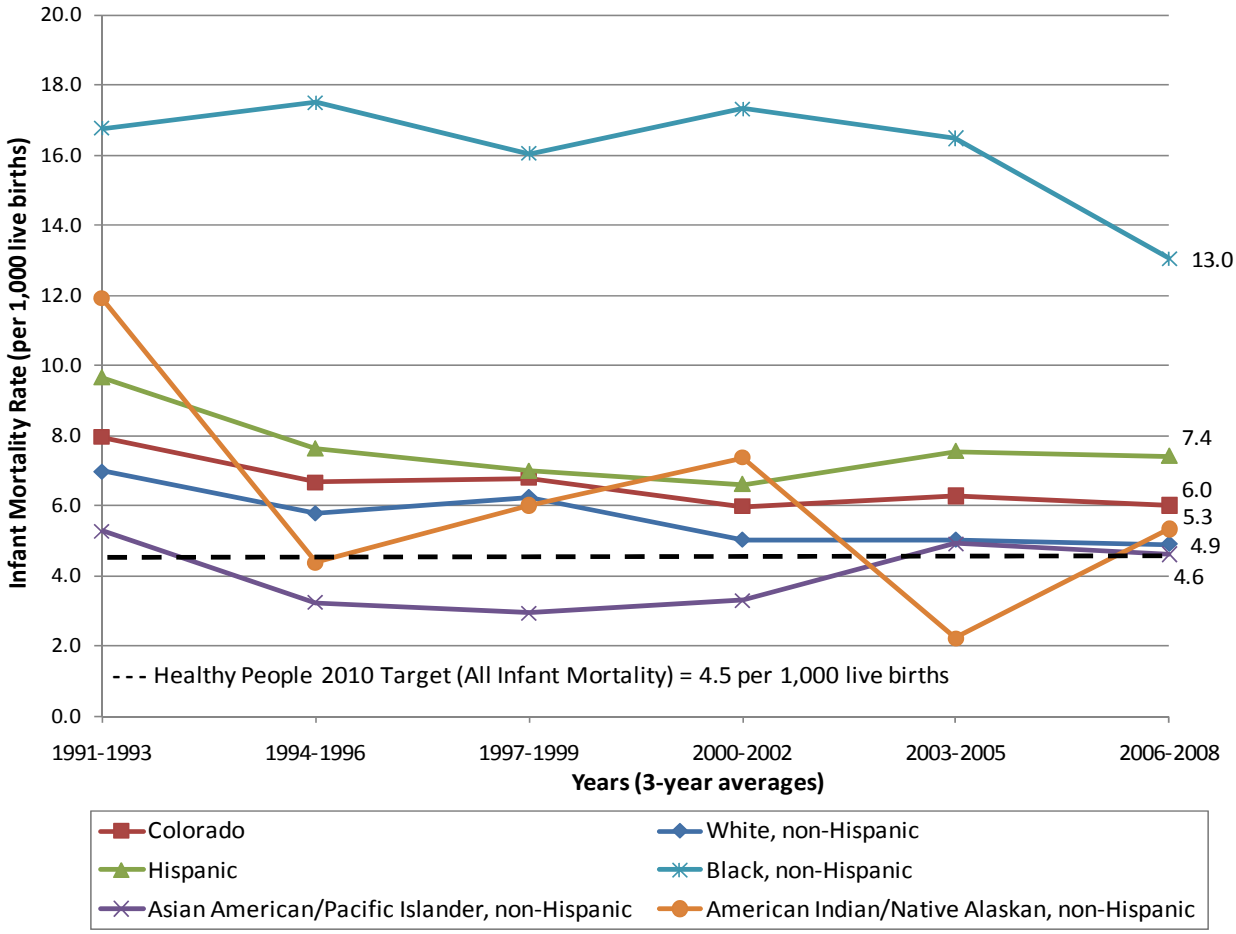

Figure 34. Infant Mortality Rates for Colorado and Select Racial/Ethnic Populations 3-year Averages, Colorado Residents, 1991-1993 to 2006-2008

Source: Colorado Department of Public Health and Environment, Colorado Vital Statistics

In Colorado, over 95 percent of Hispanic births occur to women who were born in either the United States or Mexico.[26] Since 1991, U.S.-born Hispanic women have experienced a higher rate of infant mortality compared to Mexico-born Hispanic women (Figure 35). Over time, the difference in rates appears to be narrowing, as the infant mortality rate of U.S.-born Hispanic women decreases and the rate of Mexico-born Hispanic women rises. Both rates exceed the Healthy People 2010 (HP 16-1) target to reduce all infant deaths to 4.5 per 1,000 live births.

Infant mortality rates also vary by county of residence. Using a five-year annual average from 2003–2007, differences in rates can be observed for Colorado's 64 counties (Figure 36): 20 counties met the Healthy People 2010 target, 6 counties were close to the target, 18 counties were at some distance from the target, and 7 were very far from the target.

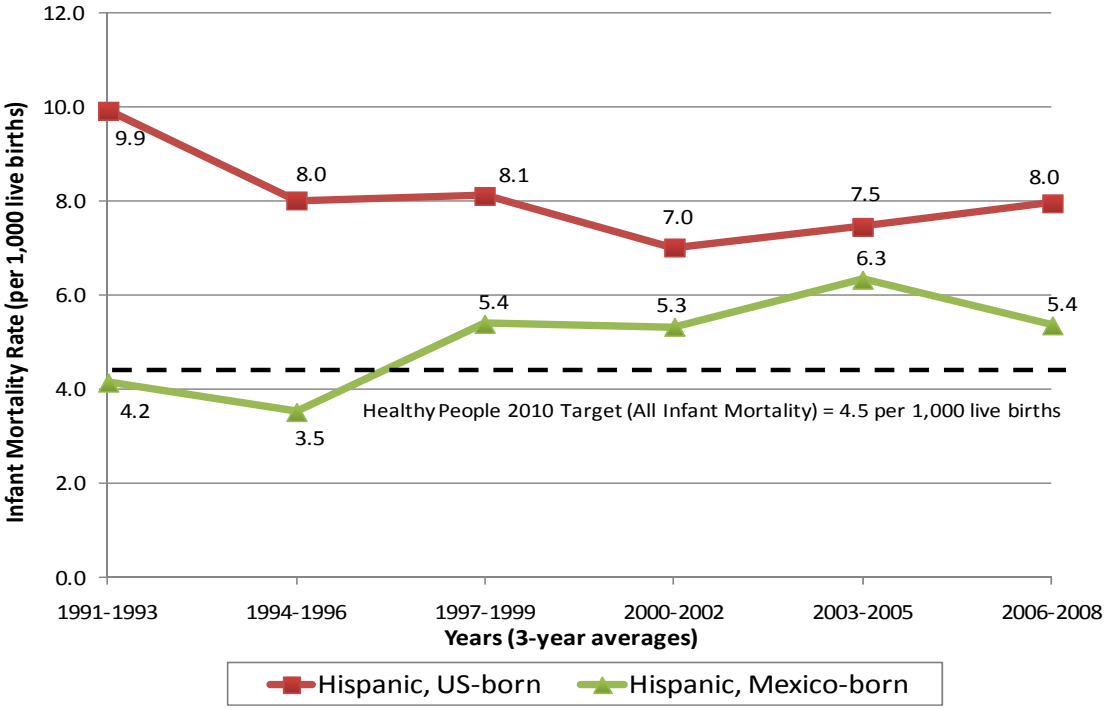

Figure 35. Infant Mortality Rates of US-born and Mexico-born Hispanic Women 3-year Averages, Colorado Residents, 1991-1993 to 2006-2008

Source: Colorado Department of Public Health and Environment, Colorado Vital Statistics

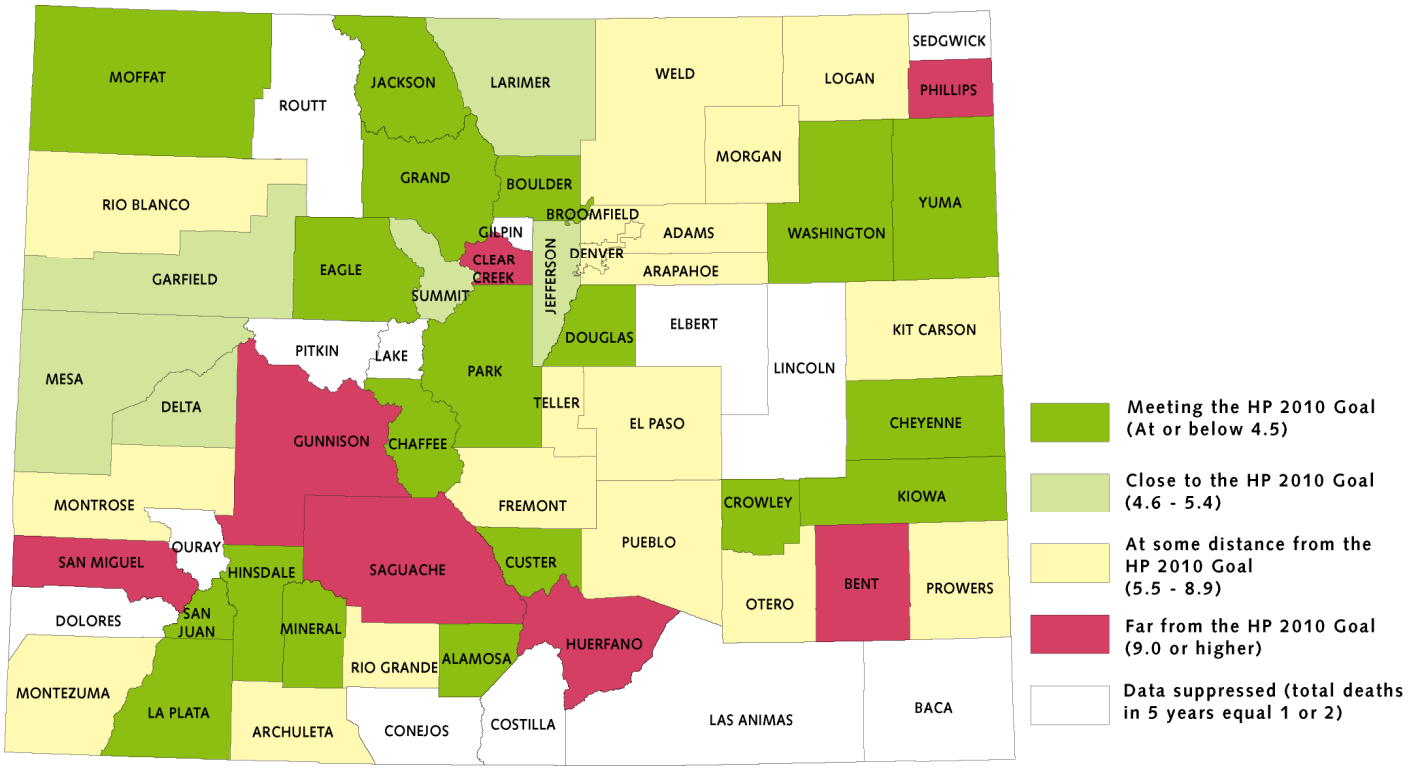

Figure 36. Five-year Average Infant Mortality Rates in Relation to the Healthy People 2010 Objective, by Colorado County, 2003–2007

Source: Colorado Department of Public Health and Environment, Colorado Vital Statistics

Causes of Infant Mortality

In this section, causes of infant mortality will be examined including perinatal period conditions, congenital anomalies/birth defects, sudden infant death syndrome and both intentional and unintentional injuries.

Perinatal Period Conditions and Congenital Anomalies

Leading causes of infant deaths include perinatal period conditions and congenital anomalies. The perinatal period condition classification means that death occurred around the time of birth from disorders related to the age of gestation (preterm birth), fetal growth, birth trauma, infections or other conditions. Congenital anomalies/birth defects include defects of the cardiovascular, central nervous, musculoskeletal, genitourinary, and digestive systems. Between 2006 and 2008, 50.5 percent of deaths among infants less than one year of age were classified as perinatal period conditions, and 22.1 percent were classified as congenital anomalies.[5]

Unintentional Injury

Deaths from unintentional injuries (falls, poisoning, car crashes, drowning, etc.), occur rarely among infants less than one year of age, accounting for 3.2 percent of deaths during 2006-2008. During the same time period, there were 41 infant deaths from unintentional injuries in Colorado: 66 percent were among male infants and 44 percent were among female infants. Out of the total number of deaths, 22 percent were due to a motor vehicle crash, while the other 78 percent were classified as "non-transport other and unspecified." These include injuries from falls, poisonings, drowning/submersion, firearms, smoke and flames or other.

Child Abuse/Neglect and Homicide

Infant deaths from child abuse/neglect are also limited in number. Between 2004 and 2006, approximately 26 infant deaths were attributed to child abuse and/or neglect, approximately 2 percent of infant deaths during that time period. Twenty-three of these deaths were determined to be homicides. The largest proportion of infant homicides occurred among White/non-Hispanic infants (47.8 percent). However, White/Hispanic infants are the most disproportionately affected group as they comprise 25.3 percent of the infant population in Colorado but account for 34.8 percent of infant homicides.[27] When discussing homicide among children and adolescents, teen homicide rates are often perceived to be higher than infant homicide rates. However, as seen in Figure 37, the three-year moving average rates of homicide in Colorado are higher among infants compared to teens, and teen homicide rates are trending downward. Most recently (2006–2008), the homicide rate among the infant population was almost two times as high as the homicide rate among teens 15–19 years of age.

A review of infant and teen homicide cases by the Colorado Child Fatality Prevention System's State Review Team revealed differences in each age group. Between 2004 and 2006, 82 percent of teen homicides resulted from use of a firearm, and 65 percent of infant homicides resulted from physical assault (e.g. punching, beating, throwing, dropping, and shaking). Also, 14 of the 23 infant homicides (60.9 percent) were the result of shaken baby syndrome.[27]

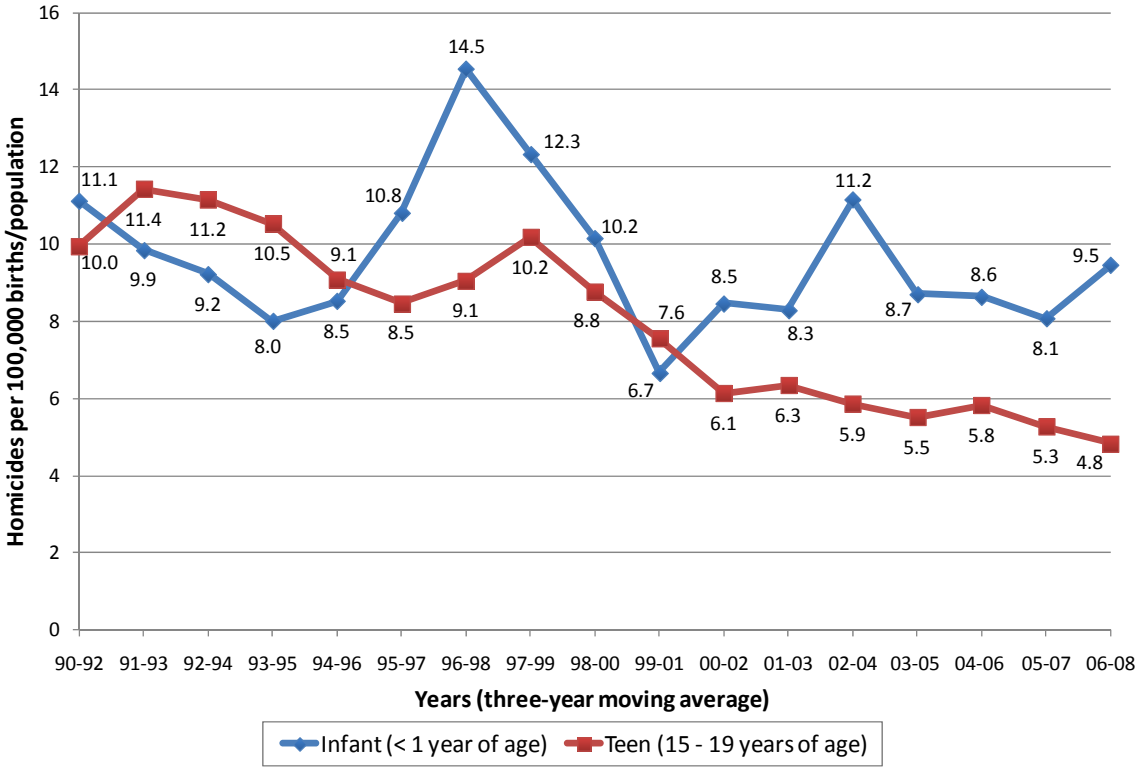

Figure 37. Infant and Teen Homicide Rates, 3-Year Moving Averages
Colorado, 1990-1992 to 2006–2008
Source: Colorado Department of Public Health and Environment, Colorado Child Fatality Prevention System

Sudden Infant Death Syndrome

Sudden infant death syndrome or SIDS, defined as "sudden death of an infant under one year of age, which remains unexplained after a thorough case investigation, including performance of a complete autopsy, examination of the death scene, and review of the clinical history."[10] Infants are at highest risk for sudden infant death syndrome during the first six months of age, and are most vulnerable in their second and third months. Male babies are at higher risk than females. Other risk factors include preterm and/or at a low weight birth, birth during the fall or winter months, exposure to tobacco smoke, and overheating while sleeping.[28] In addition, the risk of sudden infant death is higher among infants born to women with inadequate prenatal care, placental abnormalities, inadequate weight gain during pregnancy, anemia, a history of sexually transmitted or urinary tract infections, women who smoke or use drugs, and women 20 years of age and younger.[28]

To help prevent cases of sudden infant death syndrome, the American Academy of Pediatrics released guidelines in 1992 for infants to be placed in a non-prone sleep position (not on the stomach). By 2005, these guidelines were updated to include use of a pacifier while sleeping, avoiding soft bedding and soft objects in the infant's sleep environment, prohibiting co-sleeping (sleeping with an infant), and promoting room sharing (infant sleeps in the same room as the caregiver).[20, 29] Implementation of these recommendations have helped reduce Colorado's rate

of sudden infant death syndrome significantly, from 2 per 1,000 live births in 1990 to 0.5 per 1,000 live births in 2008. However, Colorado is still not meeting the Healthy People 2010 Objective 16-1, which is to reduce deaths from sudden infant death syndrome to 0.25 per 1,000 live births. In 2008, 81 percent of Colorado women reported placing infants on their back to sleep.[30] This result surpasses Healthy People 2010 Objective 16-13, of 70 percent.[1414]

Increased adherence to safe-sleep recommendations does not completely explain the reduction in sudden infant death syndrome rates. National studies indicate that the decline in rates may also be attributed to changes in the classification of death by coroners and medical examiners.[29] As the rates of sudden infant death syndrome have declined over time, infant mortality due to accidental suffocation and strangulation in bed, plus deaths reported as unknown or unspecified have increased (from 2.8 per 100,000 in 1984 to 12.5 per 100,000 live births in 2004).[31] Coroners and medical examiners are becoming less likely to report an infant death as sudden infant death syndrome without a thorough death scene investigation or when there is sufficient evidence that the infant death occurred in an unsafe sleep environment.[32]

One of the leading risk factors for sudden unexpected infant death is co-sleeping. Data from the Colorado Child Fatality Prevention System provides a comprehensive picture of sleep-related infant deaths in Colorado.[27] Between 2004 and 2006, approximately 159 Colorado infant deaths were identified as a sleep-related death by the review team. As seen in Figure 38, over half (55 percent) of the sleep-related deaths occurred in an adult bed, couch, or futon; approximately one-third (30 percent) occurred in a crib or bassinette; 9 percent occurred in other places including the playpen, car seat, and stroller; and in 6 percent of the sleep-related cases, the location was unknown.

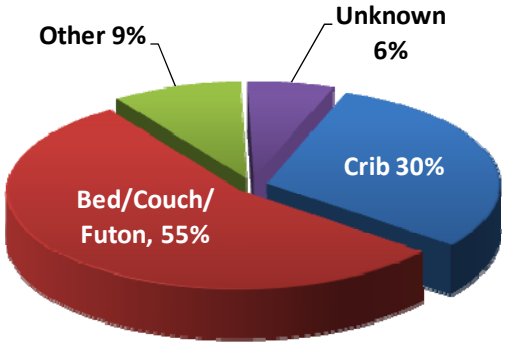

Figure 38. Location of Sleep-related Infant Deaths, Colorado, 2004-2006
Source: Colorado Department of Public Health and Environment, Colorado Child Fatality Prevention System

Of the 159 sleep-related infant deaths identified, 73 (45.9 percent) occurred while co-sleeping. In approximately 32 of the 73 (44 percent) co-sleeping cases, two or more persons shared the bed with the newborn – studies show an association between sudden infant death syndrome and co-sleeping with two or more individuals.[29] In terms of race/ethnicity, the majority of co-sleeping infant deaths occurred among the White/non-Hispanic population (57.5 percent), followed by the White/Hispanic (21.9 percent), Black/African American (17.8 percent), and American Indian/Native American (2.7 percent) populations. However, when accounting for the

proportion of live births to Black/African American and American Indian/Alaskan Native American women in Colorado, the percentage of co-sleeping deaths is disproportionately higher than among other racial and ethnic groups.[27]

Neonatal Infant Mortality

Infant deaths can be analyzed further by classifying age groups as neonatal (less than 28 days) or postneonatal (28 days to less than one year). The mortality rate among neonates is consistently higher than the mortality rate during the postneonatal period. In terms of neonatal deaths, racial and ethnic disparities exist among Black/African American infants and White/Hispanic infants when compared to other racial and ethnic groups.

As seen in Figure 39, the three-year average neonatal mortality rate has consistently been significantly higher for Black/African American infants, at 2-3 times that of other groups for most time periods. The neonatal mortality rate is also consistently higher among White/Hispanic infants, when compared to White/non-Hispanic and Asian American/Pacific Islander infants. (Data were suppressed for the Native American/Alaskan Native population, due to fewer than three infant deaths in some of the three-year averages). A decrease in the Black/African American neonatal mortality rate was observed during the 2006–2008 period. It is difficult to determine if this decrease was due to fluctuations in live births or infant deaths or a combination of both. Also, the rate appears to be increasing among the Hispanic population. Only the Asian American/Pacific Islander population has met Healthy People 2010 Objective 16-1, which is no more than 2.9 infant deaths per 1,000 live births.

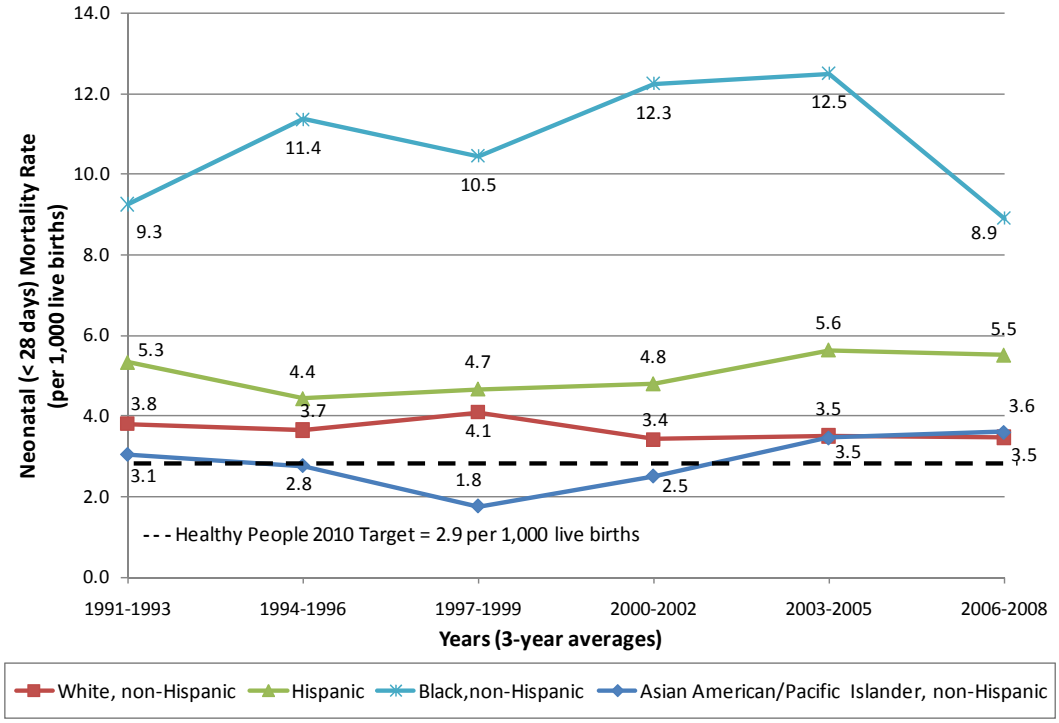

Figure 39. Neonatal (<28 days) Mortality Rates by Select Racial/Ethnic Populations Three-Year Averages, Colorado Residents, 1991-1993 to 2006–2008

Source: Colorado Department of Public Health and Environment, Birth Certificate Data

Postneonatal Infant Mortality

Over time, the neonatal infant mortality rate has remained constant; however, the postneonatal (28 days to less than one year) infant mortality rate has decreased from 3.6 per 1,000 live births (1991–1993) to 1.4 per 1,000 live births (2006–2008). Similar to neonatal mortality, racial and ethnic disparities exist in postneonatal mortality.[xx] As seen in Figure 40, the three-year average postneonatal mortality rate is significantly higher for Black/African American infants compared to the White/Hispanic and White/Non-Hispanic populations. Unlike the neonatal mortality rates, the postneonatal mortality rate is decreasing over time among all three populations; however, no group has declined to the Healthy People 2010 Objective 16-1 of 1.2 deaths per 1,000 live births.

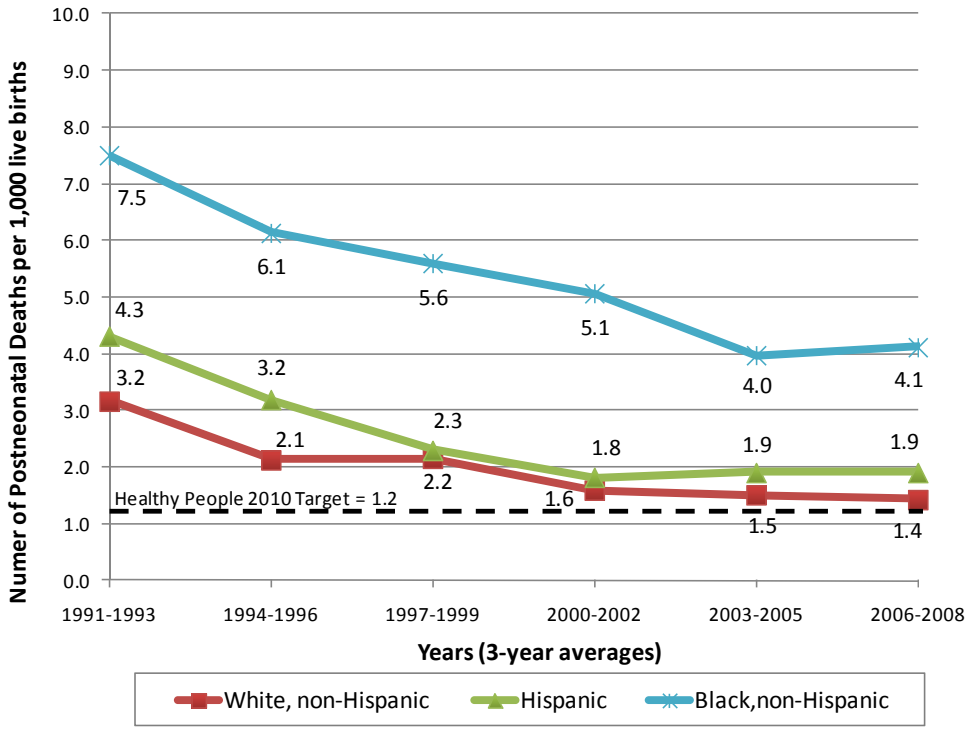

Figure 40. Postneonatal (28 days to <1 Year) Mortality Rates by Select Racial/Ethnic Populations 3-Year Averages, Colorado, 1991-1993 to 2006-2008

Source: Colorado Department of Public Health and Environment, Colorado Vital Statistics

Section 3: Infant Morbidity

Infant morbidity refers to adverse infant conditions that occur after birth and before one year of age. Factors affecting infant morbidity include premature birth and low birth weight, injury, environmental exposures such as secondhand smoke, and access to care for infant health.

[xx] Data was suppressed for the Asian American/Pacific and Native American/Alaskan Native populations, due to fewer than three infant deaths in some of the three-year averages.

Low birth weight

A low birthweight infant is defined as weighing less than 2500 grams at birth (5 pounds, 8 ounces or less). Low weight can be associated with increased morbidity including long-term developmental and neurological complications and disabilities, and infant mortality. Low birth weight is a common result of a preterm birth (a gestational age of less than 37 weeks), accounting for 65 percent of low birthweight infants born in Colorado, while 35 percent of those with a low birth weight are born at term.

In 2007-2008, 8.9 percent of Colorado live births were classified as low birthweight and approximately 1.2 percent were classified as very low birthweight (<1,500 grams). Colorado's low birthweight rate has fluctuated little over the past ten years and is higher than the U.S. rate (approximately 8 percent each year). Both the U.S. and Colorado low birthweight rates exceed Healthy People 2010 Objective 16.1, which is to reduce the proportion of low weight births to 5 percent of all live births.

In both Colorado and the U.S., racial and ethnic health disparities exist in the area of low weight births. According to the latest Colorado birth certificate data available (2007-2008), Black/African American infants had the highest proportion of low weight births, compared to all live births within that population, at 15.1 percent. This is up to 1.75 times higher than other racial and ethnic groups. Asian American/Pacific Islander infants also had a low birthweight rate higher than other racial and ethnic groups for the same time period, at 11.2 percent. Figure 41 illustrates low weight births as a percentage of all live births, by race and ethnicity. The percentages have remained stable over time and are similar to national rates.

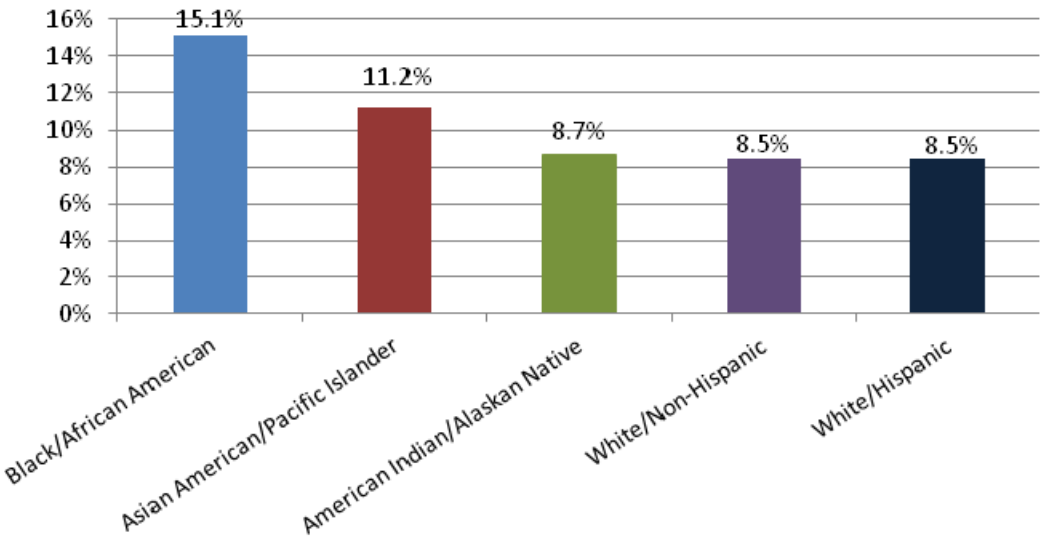

Figure 41. Low Weight Births as a Percent of Live Births by Race and Ethnicity, Colorado, 2007-2008

Colorado Department of Public Health and Environment, Birth Certificate Data

White/Non-Hispanic infants make up the largest proportion of births in the state, and therefore have the greatest number of low weight births. Of the approximately 6,000 low birth weight

infants born in Colorado each year, 55 percent or approximately 3,300, occur among White/Non-Hispanic Infants. Twenty-five percent occur among and White/Hispanic infants, the second largest racial and ethnic group by population.

In 2000, the Colorado Department of Public Health and Environment examined the problem of low birth weight in a report entitled *Tipping the Scales: Weighing in on Solutions to the Low Birth Weight Problem in Colorado,* which focused on births between 1995 and 1997. Along with non-modifiable factors contributing to low birth weight (such as premature rupture of the membranes), the report identified two important modifiable factors: smoking and inadequate weight gain during pregnancy.

In a recent analysis of the 2007-2008 birth cohorts, similar observations were identified. In 1995-1997, the low birthweight rate for women who did not gain enough weight during pregnancy was 9.4 percent, and by 2007-2008 this increased to 11.6 percent. For smoking, the low birthweight rate was 13.4 percent (1995-1997), higher than the 12.3 percent observed in 2007-2008. Figure 42 shows low birthweight rates for singleton births (2007-2008) by weight gain (based on the 1990 Institute of Medicine's recommendations), and pregnancy smoking status. Across all weight gain categories, the low birthweight rate was higher for smokers compared to nonsmokers with the greatest rate observed among women who were both underweight and smokers (19.5 percent).

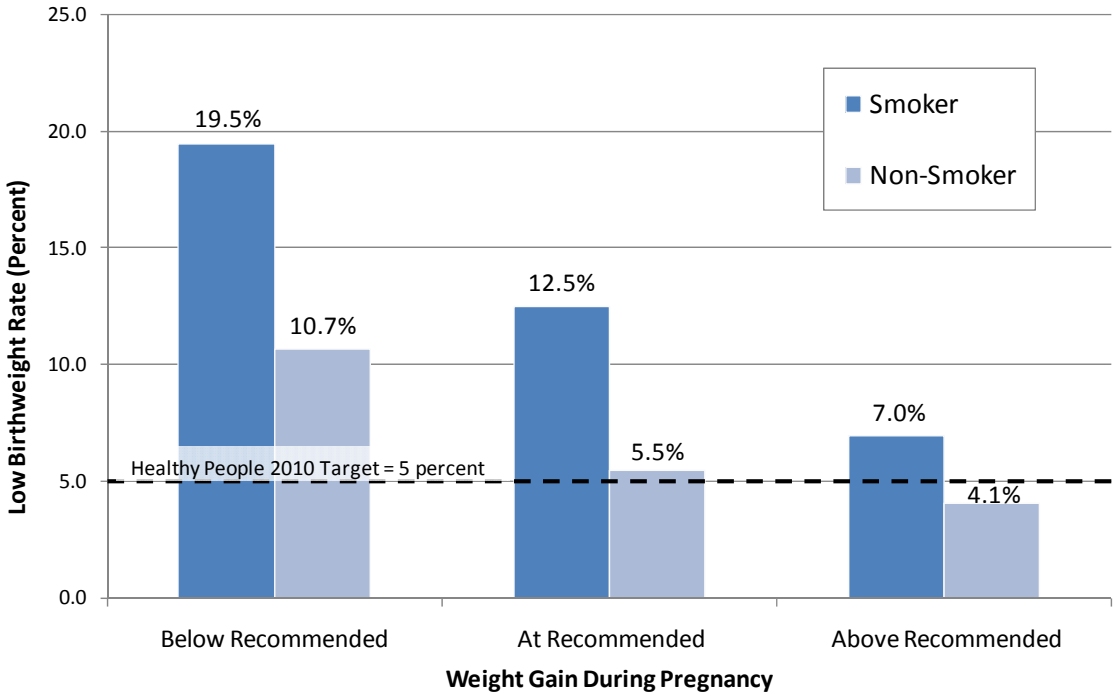

Figure 42. Low Birthweight Rates by Recommended Weight Gain Category and Smoking Status During Pregnancy, Colorado, 2007-2008
Source: Colorado Department of Public Health and Environment, Birth Certificate Data

Using birth certificate data for 2007-2008, a relative risk analysis was performed to measure the association between a women having the two risk factors of inadequate weight gain and smoking during pregnancy, and then giving birth to a low birthweight baby. Compared to women with adequate and excessive weight gain, the probability of low birth weight is almost two times as high [RR = 1.74 (95% CI = 1.66, 1.83)] among women with inadequate weight gain. Similarly, compared to women who did not smoke during pregnancy, the probability of low birth weight is almost two times as high [RR = 1.81 (95% CI = 1.69, 1.94)] among women who smoked during pregnancy. Women who smoked and had inadequate weight gain during pregnancy were almost four times more likely [RR = 3.66 (95% CI = 3.35, 3.99)] to have a low birthweight baby compared to women who did not smoke and gained adequate weight during pregnancy.[33]

Premature birth

Defined as birth between 20 and 37 weeks gestation, premature birth is the leading cause of death among infants. The United States has a high proportion of premature births compared to other industrialized nations. All preterm infants are at a significant risk for health problems and the earlier the birth, the greater the risk.[34] Preterm delivery is associated with lifelong intellectual disabilities, cerebral palsy, breathing and respiratory problems, vision and hearing loss, and feeding and digestive problems.

Known risk factors for preterm delivery include a history of preterm delivery; uterine, cervical or placental dysfunction; lifestyle and environmental risks (smoking cigarettes, drinking alcohol, using illicit drugs, poor nutrition, and stressful life events); and medical risks (high blood pressure, diabetes, clotting disorders, being underweight or overweight before pregnancy, multiple miscarriages or abortions, and physical injury or trauma).[35] Another major factor influencing the rise in preterm births is the use of assisted reproductive technology for conception, which increases the likelihood of multiple births and therefore, preterm births.[35]

In 2006, the rate of premature births in the United States was 12.8 percent. In Colorado, the rate of preterm delivery is lower, but has been rising. As illustrated in Figure 43, the percentage of live births delivered preterm in 2000 was 9.0 percent, which increased to 9.6 percent by 2008. While small numbers may help explain the variation among the American Indian/Alaskan Native and Asian American/Pacific Islander populations, the Black/African American population in Colorado continuously demonstrates the highest rate of preterm delivery compared to all other racial/ethnic groups; this disparity is observed over time and is also seen nationally.

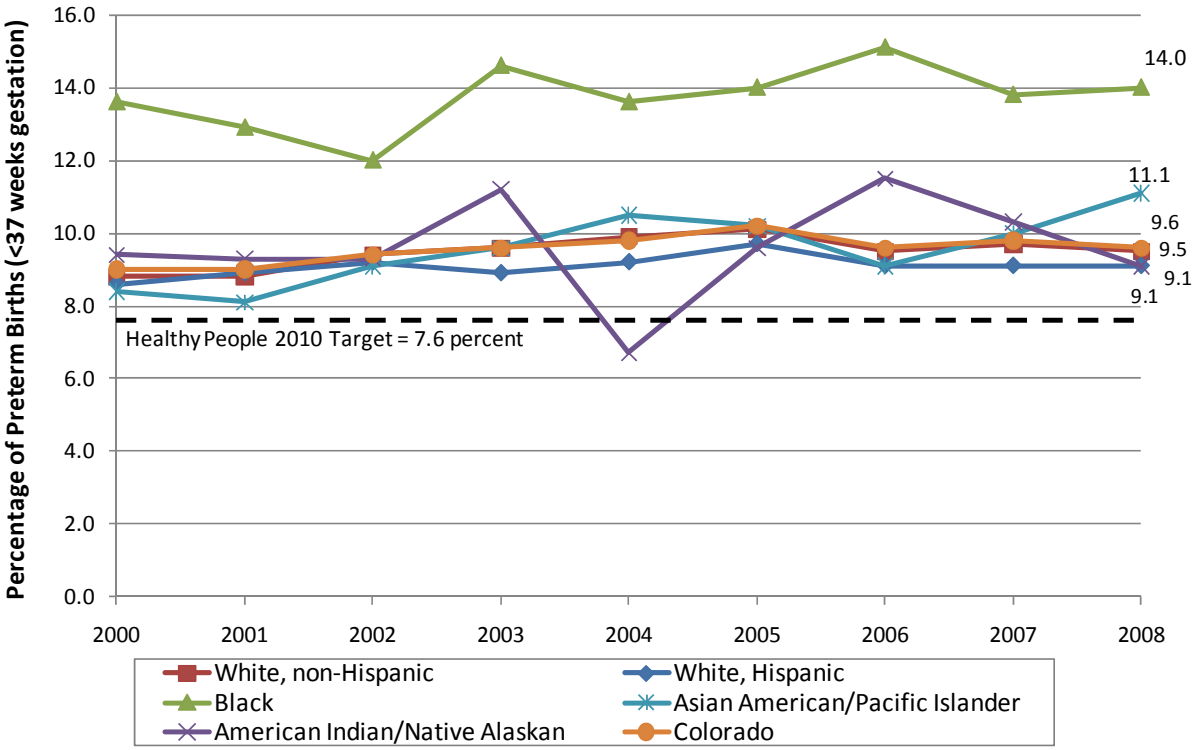

Figure 43. Percent of Live Births Delivered Preterm (< 37 weeks gestation)
Colorado Total Births and Births by Race and Ethnicity, 2000-2008
Source: Colorado Department of Public Health and Environment, Birth Certificate Data

Preterm infants born between 34 and 36 weeks have fewer complications than infants born earlier, but are still at risk for jaundice, breathing problems, longer hospital stays, and an increased risk of death in the first year of life.[36] The rates of late preterm delivery (defined as births between 34-36 weeks) have risen both nationally, in Colorado, and among all age groups. In the United States, the rate has increased 19 percent between the time periods 1990-1991 and 2005-2006 (from 6.8 percent of live births to 8.1 percent of live births respectively). During this same time period, Colorado experienced a 22 percent increase from 6.4 percent to 7.8 percent of all live births. Women under 20 years of age and women ages 40 and older are the most likely to have a late preterm delivery.[36] Although many factors contribute to late preterm delivery, recent research suggests that the increasing use of induction of labor and cesarean delivery at 34 to 36 weeks is a contributing factor.[37-38]

Neural Tube Defects

Neural tube defects such as anencephaly and spina bifida are two causes of infant morbidity that can be prevented. During 2001– 2005, the Colorado prevalence of anencephaly (1.3 per 10,000 live births) and spina bifida (3.4 per 10,000 live births) were lower than the prevalence observed in the United States (2.5 per 10,000 live births and 3.7 per 10,000 live births, respectively). Colorado is close to meeting Healthy People 2010 Objective 16-15 to reduce the occurrence of spina bifida and other neural tube defects to 3 per 10,000 live births.[39] One successful prevention strategy is the use of folic acid to reduce neural tube defects. For

pregnant women, folic acid should be consumed every day in the form of a prenatal vitamin or a multivitamin. In Colorado during 2008, only 33 percent of women reported taking such a supplement every day in the month prior to pregnancy, according to PRAMS. This result is far below Healthy People 2010 Objective 16-16, which is to increase the proportion of pregnancies to 80 percent that begin with an optimum level of folic acid.[14, 40]

Access to Health Care

Visiting a health care professional after hospital discharge enhances the health of the infant by reducing morbidity through checkups, preventive services and follow-up. In Colorado, the proportion of infants who see a health care worker within the first week after leaving the hospital is increasing. In 2004, 91 percent of infants were seen by a health care worker during the first week post discharge, which increased to 94 percent by 2008.[14]

After the initial visit with a health care worker, the infant is scheduled for well-baby checkups that occur every two months for the first six months. In 2008, almost all (98 percent) Colorado infants had a well-baby checkup. Well-baby exams are most likely to occur when the infant is covered by some type of health insurance. In 2008, 55 percent of Colorado infants were covered by private insurance or an HMO, 38 percent were covered by Medicaid, 4 percent were covered by Child Health Plan Plus, and 2 percent of infants had no insurance.[14] Health insurance coverage for infants in Colorado is quite good, which is reflected in the high proportion receiving health checkups within the first several months of life.

Screening[xxi]

Screening for disorders is also enhanced among infants with health insurance. Screening for metabolic conditions, conducted between three and five days after birth, identifies those that may lead to significant morbidity or mortality. A second screening is conducted between 8 and 14 days of age to identify conditions that may have been missed during the first round of screening. Each year, an average of 70,000 Colorado infants are screened, and of those, 2,000 have a positive or abnormal screen, with about 100 ultimately diagnosed with a disease.

In addition to metabolic screening, all Colorado infants are screened for hearing disorders. Approximately 200 infants are identified with significant hearing loss at birth. In 2008, 97.8 percent of Colorado infants participated in a hearing screening. The Healthy People 2010 objective specific to newborn screening is being reassessed, but a modified objective specific to both screening and follow-up is proposed for Healthy People 2020 (MICH HP2020-22).

Injury Hospitalizations

Injury requiring hospitalization is rare among infants less than one year of age. In 2008, in a population of 71,067 infants, only 211 infants were hospitalized for injury, including 128 males and 83 females. Among the male infants, 57 percent of the hospitalizations were due to unintentional injuries (i.e., falls and other accidents), and 24 percent were due to intentional injuries (i.e., child abuse and neglect). In 19 percent of cases, the cause was undetermined.

[xxi] See http://www.cdphe.state.co.us/ps/hcp/nbms/index.html about the Colorado Newborn Screening Programs.

Similarly among female infants, 57 percent of hospitalizations were due to unintentional injuries, while 31 percent were due to intentional injuries. The cause was undetermined in 12 percent of cases.

As seen in Figure 44, the hospitalization rate of infants for unintentional injuries has been decreasing over time for both genders, while the intentional injury hospitalization rate has remained fairly constant. Most notable is the disproportionate rate of males hospitalized for injuries compared to females.

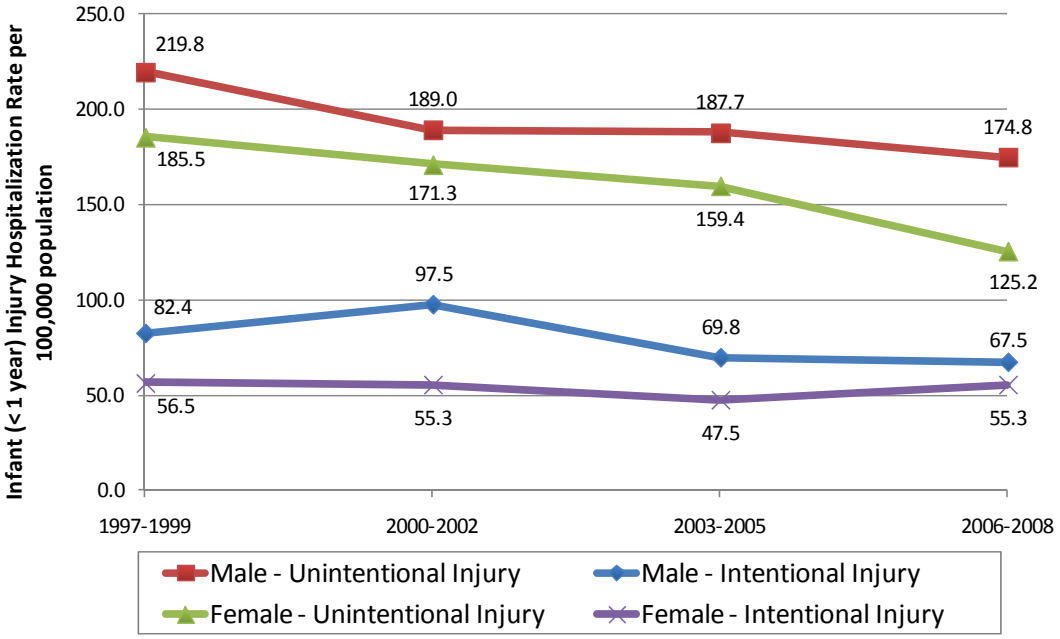

Figure 44. Unintentional and Intentional Injury Hospitalization by Gender
Two-year Annual Average Rates per 100,000 Population, Colorado, 1997-1999 to 2006-2008
Source: Colorado Trauma Registry, Hospitalization Data

Secondhand Smoke Exposure

Secondhand smoke is the smoke that comes from the burning end of a cigarette, cigar, or pipe, which is also exhaled by smokers. In many instances, exposure to secondhand smoke presents health hazards comparable to smoking. Infants exposed to secondhand smoke are at risk for sudden infant death syndrome, and children living in homes where people smoke are more likely to get sick with respiratory problems.

As seen in Chapter 3, the percentage of women who report smoking after delivery is decreasing with a greater proportion of Hispanic women (all races) remaining nonsmoking compared to non-Hispanic women (all races). Over five years, the prevalence of smoking in the same room as the infant has decreased from 5.2 percent in 2002 to 2.1 percent in 2007.[14] In 2008, 2.2 percent of Colorado women reported a husband/partner smoking in the house, and 3.4 percent reported that someone else besides the mother, husband/partner smoked in the house.[14]

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